State Form 43207 (2-89)

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

INDIANAPOLIS

OFFICE MEMORANDUM

DATE: December 27, 1989

TO: Bruce Oertel
Site Investigation Section

THRU: Karyl K. Schmidt KS 1-2-90
Harry Atkinson 1/10/90

FROM: Billy Giles BGA
Geology Section 12/28/89

SUBJECT: Dodge Manufacturing Company Site
St. Joseph County
Geologic Assessment

INTRODUCTION

The Dodge Manufacturing Company Site has been used as a dump for foundry waste since the 1940's. The waste may include heavy metals, PCB, solvents, acids, and bases. The site may have been a gravel pit at one time. Residential wells are within 100 feet of the site, and the Mishawaka municipal well field is within two miles.

The site is located approximately 1 1/2 miles south of downtown Mishawaka off Union Street (SR331). The location is Section 27, T. 37 N., R. 3 E.

SOILS

The soils that underlie the site belong to three soil series: the Miami, the Oshtemo, and the Riddles. The Miami series covers the southern three quarters of the site. The Oshtemo series is found in the north central portion of the site along an intermittent stream. The Riddles series is located in two tracts on either side of the Oshtemo series in the northeast and northwest corners of the site.

The Miami series consists of deep, well-drained, gently sloping to strongly sloping soils formed in loamy glacial till. Miami soils have moderate and moderately slow permeability and a high available water capacity. Runoff is medium to rapid. The organic matter content is generally moderate in the surface layer, but is low where the soils are severely eroded. Hydraulic conductivities are usually in the range of 10^{-4} to 10^{-5} cm/sec.

In a representative profile of the Miami series, the surface layer is dark-brown loam about 8 inches thick. The subsurface layer is brown loam 6 inches thick. The subsoil is 24 inches thick. It is dark yellowish-brown, firm clay loam in the upper 6 inches, and yellowish-brown, firm clay loam in the lower 18 inches. The underlying material is brown heavy loam that extends to a depth of 60 inches.

The Miami soil that underlies the site is Miami loam, 6 to 12 percent slopes, eroded. This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner, and some subsoil material is mixed into the surface layer. Erosion is a major concern with this soil.

The Oshtemo series consists of deep, well-drained, nearly level to strongly sloping soils on outwash plains and terraces. Oshtemo soils have moderately rapid permeability and a low available water capacity. Hydraulic conductivities are usually in the range of 10^{-3} to 10^{-5} cm/sec. The organic matter content is high in the surface layer. Runoff is slow to medium.

In a representative profile of the Oshtemo series, the surface layer is very dark grayish-brown sandy loam about 6 inches thick. The subsurface layer is dark-brown sandy loam 10 inches thick. The subsoil is 38 inches thick. It is dark-brown, firm, gravelly sandy clay loam in the upper 12 inches and strong-brown, friable loamy sand in the lower 26 inches. The underlying material is light yellowish-brown, stratified sand that extends to a depth of 60 inches.

The Oshtemo soil that is located along the intermittent stream on the site is Oshtemo sandy loam, 2 to 6 percent slopes. This soil has the profile described as representative of the series. Droughtiness is a major concern with Oshtemo soils, and soil blowing is a hazard when the soil is dry if it has no protective cover.

The Riddles series consists of deep, well-drained, nearly level to strongly sloping soils formed in loamy glacial tills. Riddles soils have moderate permeability and a high available water capacity. Hydraulic conductivities are usually in the range of 10^{-4} to 10^{-5} cm/sec. The organic matter content is moderate in the surface layer. Runoff is slow to rapid.

In a representative profile of the Riddles series, the surface layer is dark grayish-brown loam about 9 inches thick. The subsoil is 53 inches thick. It is dark yellowish-brown, firm loam in the upper 3 inches; dark yellowish-brown clay loam in the next 18 inches; yellowish-brown firm light clay loam in the next 16 inches; and brown, firm loam in the lower 16 inches. The underlying material is brown loam that extends to a depth of 72 inches.

The Riddles soil that is located in the northeast and northwest portions of the site are Riddles loam, 12 to 18 percent slopes, eroded. This soil has a profile similar to the one described for the series as representative, but its surface layer and subsoil are thinner. Some dark yellowish-brown clay loam from the subsoil is mixed with the surface layer. This soil is found on narrow, elongated ridgetops and knolls along small streams and drainageways. Erosion is a major concern.

GEOLOGY

The bedrock surface beneath the site is the Devonian-age Ellsworth Formation. The Ellsworth is composed of gray, green, and black shales. The site is located northeast of the crest of the Kankakee Arch; thus, the bedrock dips northeast toward the center of the Michigan Basin.

The unconsolidated deposits above the bedrock are more than 200 feet thick at the site. An oil exploration well approximately one mile south of the site hit bedrock at 250 feet. The geology of the unconsolidated deposits in the vicinity of the site are rather complex. The surficial deposits at the site are clayey and silty tills of the Wedron Formation of the Lake Michigan lobe of Wisconsinan age. Beneath the surface are layers of sandy till and sand and

gravel outwash deposits. Approximately 1/2 mile west of the site is an area of complex mixed drift; till deposits and stratified outwash in chaotic form. Approximately 1/2 mile north of the site are the outwash sand and gravels of the St. Joseph River floodplain.

The site is located near the crest of a ridge that is composed of glacial till. The site is about 150 feet higher than the floodplain of the St. Joseph River to the north. Steep-sided ravines are cut into the margin of the ridge, one of which dissects the site.

HYDROGEOLOGY

The surface water drainage from the site is to the north by way of a ravine onto the floodplain of the St. Joseph River. Once on the floodplain the surface water apparently becomes subsurface water either by being channeled into the storm sewers of Mishawaka, or by entering the ground water supply by infiltrating through the sand and gravel outwash of the floodplain.

The bedrock aquifer is not used as a source of water in this area and the great thickness of the unconsolidated deposits make contamination of the ground water in the bedrock unlikely.

The unconsolidtaed glacial drift above the bedrock serves as the principal source of water in the South Bend/Mishawaka area. Industrial and municipal wells in the area are completed in the St. Joseph Aquifer System which is composed primarily of outwash sand and gravels deposited by the St. Joseph River and its tributaries. This aquifer is the major source of water for the area and is located downgradient from the Dodge Manufacturing Company site. Ground water and surface water exiting the site to the north could eventually enter the St. Joseph Aquifer System. The Mishawaka municipal well field is directly downgradient from the site near the St. Joseph River.

The Dodge Manufacturing Company site is located above the Hilltop Aquifer System which is comprised largely of sand and gravel units. To the north the St. Joseph Aquifer System in the outwash valley forms a distinct topographic contrast with the Hilltop Aquifer which occurs at a higher elevation. A poorly defined band of surficial sand and gravel, often more than 100 feet thick, extends north south through the middle of the system. Clayey till units thicken to the east where the site is located; however, they seldom exceed 40 feet in thickness. In the northern third of the system where the site is located, many wells are completed in a 10-30 foot thick sand and gravel unit found at an elevation of 720-690 feet, an elevation that virtually matches the St. Joseph surficial sand and gravel complex immediately to the north. Wells in the south half of the system are typically completed in thick sand and gravel units ranging in elevation from 750-670 feet. The Hilltop Aquifer System is one of moderate ground water availability (25-150 gpm) and is susceptible to ground water contamination.

The piezometric surface at the site ranges between 775-750 feet, 100-150 feet below the ground surface. On the outwash plain to the north, the piezometric surface is only about 10 feet below the ground surface. The hydraulic gradient causes ground water to flow north from the site across the outwash plain to the St. Joseph River. The hydraulic conductivity of the glacial till at the site is probably in the range of 10^{-6} to 10^{-4} cm/sec., but many of the sand and gravel layers may have greater hydraulic condutivities.

SUMMARY AND RECOMMENDATIONS

The Dodge Manufacturing Company site is located in an upland area of relatively permeable glacial till and is hydraulically connected to the even more permeable outwash plain adjacent to the St. Joseph River. Ground water flow is to the north toward the St. Joseph River and Mishawaka. A significant number of residential wells are located in close proximity to the site, and while the aquifer of concern is rather deep (>100 feet) at the site, it is only about 10 feet deep on the outwash plain less than one mile to the north. The permeability of the unconsolidated material makes the aquifer susceptible to contamination.

Sampling at the site should include residential wells, particularly any north of the site; surface water flow in the ravine north of the site, if any is present; and any leachate that may be migrating from the site.

REFERENCES

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